

## The Effect of Problem-Based Learning With Realistic Model on Indonesian Student' Mathematical Problem Solving Skill

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**Abstract:** This research reveals the improvement of Indonesian students' mathematical problem solving skill taught by problem-based learning with realistic model. Experimental research design was used and the population of the research was junior high school grade VIII students of Muhammadiyah 25 in Rantau Prapat Indonesia. Two classes with 30 students in experimental class I and 30 students for experimental class II were chosen as the sample of the research. Moreover, data found from pretest and posttest of experimental class I and II were collected and calculated by Gain Hake pattern. The finding of the research showed that students posttest result after having taught by implementing problem-based learning with realistic media was 82, 08, and students taught by conventional teaching strategy was only 76,35. Furthermore, based on Gain pattern analysis, problem solving skill of experimental class I was higher with 0,61 than students taught by implementing conventional teaching strategy with only 0,46. Then, based on t-Test it was found that students' problem solving skill with  $t_{observed} = 3,961$  and  $t_{table} = 2,00$ . In other words,  $t_{observed} > t_{table}$ ,  $3,961 > 2,00$ . This research concluded that students' problem solving skill was higher when they were taught by problem-based learning with realistic media.

**Keywords:** problem-based learning, realistic media, problem solving skill.

## INTRODUCTION

One of the major goals that must be achieved by math students in Indonesia is the mathematical problem solving skill as stated in the regulation of Indonesia education minister No. 22 Year 2006. It emphasizes that the fundamental of mathematical thinking is problem solving which includes some capabilities, namely; understanding the problem, designing the mathematical model, solving the model, and interpreting the solution attained [1]. In addition, NCTM [2] stated that problem solving means engaging in a task for which the solution method is not known in advance. In order to find a solution, student must draw on their knowledge, and through this process, they will often develop new mathematical understanding. Therefore, mathematical problem solving is the students' capability in solving the problem by linking the problem elements with the knowledge they have in order to possess the new knowledge. In other words, problem solving will not only serve the students to face the complicated mathematical problems during teaching learning process but it also boardly engages the students to think mathematically during completing the problems outside mathematic classroom. Thus, NCTM [2] stated that problem solving skill must be the focus of school mathematics.

Yet, the reality in Indonesian math class is still far from the problem solving capabilities, especially in completing the problem solving exercises. Based on the observation through the pre test given in this research, there are only 4 out of 30 students who obtained  $> 65$  from four mathematical problem solving questions. Unfortunately other 26 students got score  $< 65$ . Obviously, this real fact shows that students' problem solving skill is exteremely low. There are two main factors affecting, namely; a) less practice, and b) students' mind set. Firstly, most students do not have much opportunities to practice their problem solving skill with other exercises. They only focus on problems given by the teacher; hence, they have their head in the clouds when the problems are different with the previous exercises. Secondly, students keep thinking that mathematic is difficult to carry out in which their mindset leads to the difficulties in performing the problem solving systematically.

As a matter of fact, the researcher attempts to implement problem-based learning to enhance students' problem solving skill. According to Amalia [3] problem-based learning is one of the models that considers the appropriate model to enhance the problem solving ability. Problem-based learning is a model that presents a contextual problem in order to stimulate students to learn. In this case, the students are expected to solve

both mathematical and real world problems. Moreover, according to Savery [4] problem-based learning is a learning approach that allows students to do research, to integrate both theory and practice, and to apply knowledge and skills in developing solution to the defined problem. Thus, problem-based learning model is appropriate teaching models of mathematic class that focuses on the students technique to solve the contextual living problems that are definitely taken from daily life. According to NCTM [2], there are four instruction in problem solving, namely:

- Build new mathematical knowledge through problem solving.
- Solves problems that arise in mathematics and in other contexts.
- Apply and adapt a variety of appropriate strategies to solve problems.
- Monitor and reflect on the mathematical process.

Related to the instruction of problem solving above, the indicators that must be achieved by the students in this research for solving the problem are stated as follows;

- Creating mathematical models.
- Determining the right problem solving strategy
- Applying the strategy in solving the problem.
- Checking the answers found

Indeed, the student will be much easier in acquiring the mathematical problems through the integration of problem-based learning and realistic media. Realistic media is the concrete object that enables the students to grasp the abstract points so that the students will be easier to perform the mathematical calculation. Hence, the students in this research will be provided with the real object related to the mathematical problem so that they will be easier in comprehending mathematical materials.

## RESEARCH METHODS

This research was conducted by applying quantitative research method with experimental research design that was designed through providing both pretest and posttest. In details, research design used in this research was visualized in table-1.

**Table-1: Research Design**

Classes	Pretest	Treatment	Posttest
Experimental I	$O_1$	X	$O_2$
Experimental II	$O_1$	-	$O_2$

Based on table above, both experimental class I and II had been given pretest in order to investigate the students' problem solving skill prior to the implementation of problem-based learning with realistic model. After knowing the pretest, the students in experimental class I would be taught by implementing problem-based learning with realistic media as the posttest, while conventional teaching strategy was applied in the experimental class II.

The population of the research was grade VIII students of Muhammadiyah junior high school in

Rantau Prapat Indonesia. Then, two classes were chosen as the sample of the research, there were 30 students for experimental class I and 30 students were decided as experimental class II. In this research, the instrument used was tests that had been related with students' mathematical problem solving skill. Then, validity, reliability, and difficulty level test had been carried out in advance so that the test was applicable for all students. Moreover, all the data found from pretest and posttest of experimental class I and II were collected and calculated by Hake pattern [5] as stated below;

$$gain = \frac{\text{posttest score} - \text{pretest score}}{\text{the highest score} - \text{pretest score}}$$

The purposes of the pattern above was to find out the students' score which were used as the data for comparing the problem solving skill between students taught by implementing problem-based learning with realistic model and students taught by conventional teaching strategy.

## FINDINGS AND DISCUSSION

Based on the data collection, it was found that there was a significant differences between students in experimental class I and students in experimental class II as seen in table-2.

**Table: The result of students' test**

Scores	Experimental class I		Experimental class II	
	Pretest	Posttest	Pretest	Posttest
Averages	56,88	82,08	56,77	76,35
The lowest scores	43,75	65,63	43,75	62,50
The highest scores	75,00	100,00	71,88	93,75
Samples	30	30	30	30

The table above showed that there was a slight difference among students' pretest score in which 82.08 for experimental class I and 56.77 belongs to experimental class II. Furthermore, there was a significant differences between students taught by implementing problem-based learning with realistic

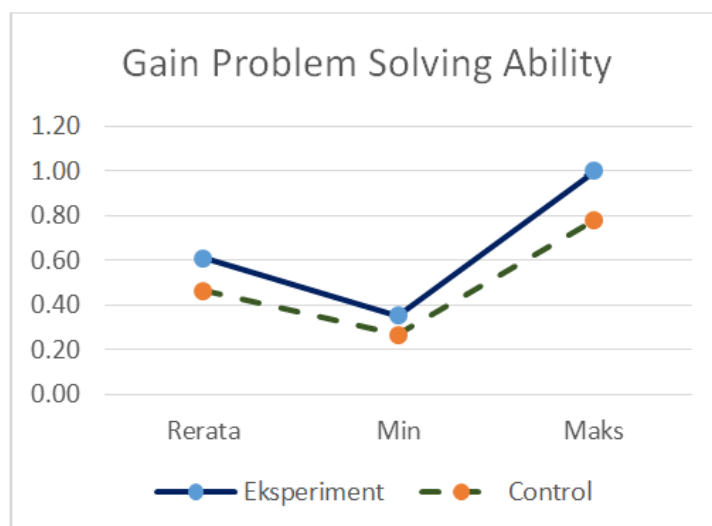
media with 82, 08 and there was only 76,35 for students taught by conventional teaching strategy. In other words, students' score in experimental class I was higher than students in experimental class II. In addition, to investigate the problem solving skill achievement was obtained through gain pattern as stated in table 3.

**Table-3: The Result of Students' Problem Solving Skill Achievement**

Scores	Experimental Class I	Experimental Class II
The Average of Gain	0,61	0,46
The Lowest Gain	0,35	0,27
The Highest Gain	1,00	0,78

Table-3 shows that the average of problem solving skill of experimental class I that taught by problem-based learning strategy with realistic media was higher with 0,61 than students taught by implementing conventional teaching strategy with 0,46. In addition, the lowest data obtained by experimental

class I remained higher than experimental class II which was  $0,35 > 0,27$ . The highest gain obtained by experimental class I was increasingly higher than experimental class II with  $1,00 > 0,78$ . In brief, the differences among the improvement of problem skill is visualized in graph-1.



**Graph-1: The Graph of Gain Problem Solving Ability**

**Table-4: The Test of Average Score**

T	df	Sig. (2-tailed)	Hypothesis	Information
3,961	58	0,000	Rejected	Significant Effect

Furthermore, the data found was analyzed by using IBM Statistics SPSS 23 as shown in table-4.

Based on table-4, it could be stated that  $\text{Sig } 0,000 < 0,05$  which means there was a significant different of students' problem solving skill taught by implementing problem-based learning with realistic model and students taught by conventional teaching strategy. Moreover, based on t-Test the, implementation of problem-based learning with realistic model significantly affected on students' problem solving skill with  $t_{\text{observed}} = 3,961$  and  $t_{\text{table}} = 2,00$ . In other words,  $t_{\text{observed}} > t_{\text{table}}$  that has shown that students' problem solving skill could be higher by the implementation of problem-based learning and realistic media. Based on

data analysis, this research pointed out that the students would be able to solve the mathematical problem as long as they served with contextual living problem through problem-based learning that allows them to think, to design, and to solve the problem mathematically. It was agreed by the previous research conducted by Amalia [3] that problem-based learning is an effective strategy applied in mathematic classroom. This strategy would enhance the students' mathematical problem solving skill. In addition, Rokhmawati [6] also concluded that the implementation of PBL models and argued that students' problem solving skill in grade IX of junior high school Muhammadiyah 4 Malang Indonesia is improved in which the students were not only able to find out the problems but they were also

able to deal with any problems found out of the mathematic classroom. Based on the data analysis, this research also revealed that problem-based learning with realistic model highly effective for math classroom, particularly in improving students' problem skill as the student would not be guided to explore their own problem but the teachers would let them to find out concrete problem, and to explore the solution related with its problems. In addition, the realistic model is a real object media used by the students with real problems that would be solved by the students. In brief, it was believed that problem-based learning strategy would be more comprehensively appropriate if it was used realistic media as the media of teaching. It is carried out in order to constantly improve students' problem solving skill.

### CONCLUSION

After analyzing the data, the research concluded that students' problem solving skill who were taught by problem-based learning with realistic media was higher than students' problem solving skill taught by conventional teaching strategy. It also showed that the students' way of thinking in solving the problems either during math teaching learning process or outside the classroom was mathematically higher than they had previously performed.

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